

Central Valley Vulnerability and Response Package Analysis

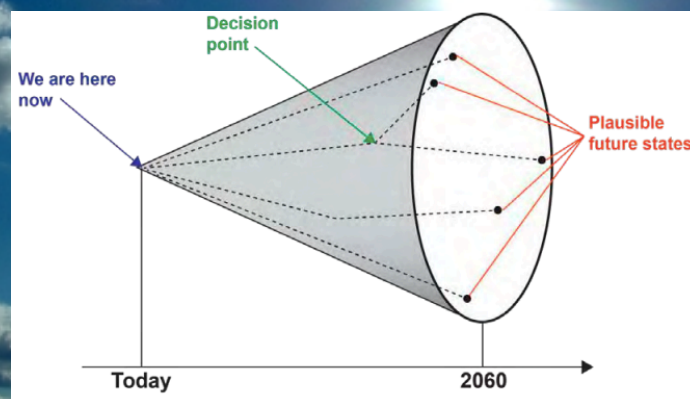
California Water Plan Update 2013
Plenary Meeting

October 30, 2013



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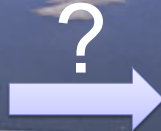
What might the future hold for California water management?



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How vulnerable is California's water management system?

- 💧 Changing climate
- 💧 Changing water use patterns



- 💧 Low reliability
- 💧 Low environmental flows
- 💧 Declining groundwater levels

How can the water management community reduce these vulnerabilities?

- 💧 Urban water reuse
- 💧 Urban water use efficiency
- 💧 Agricultural water use efficiency
- 💧 Conjunctive use
- 💧 New environmental flow targets
- 💧 New groundwater recovery targets

California Water Plan analysis looks into the uncertain future...

- ◆ Builds on the scenario analysis begun for California Water Plan 2005 Update
- ◆ Focuses on Central Valley
- ◆ Evaluates plausible futures out to 2050
- ◆ Uses improved data and tools

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Analysis guided by a structured decisionmaking approach



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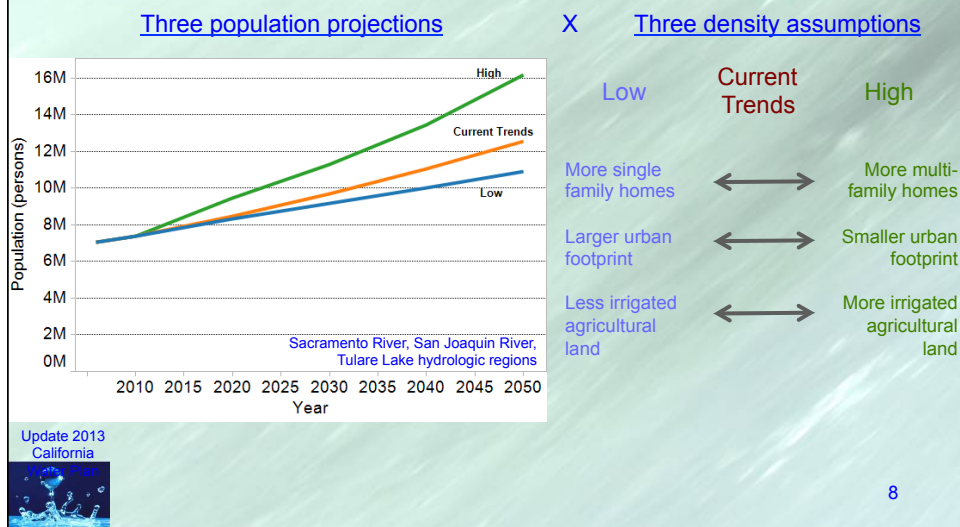
Key limitations of analysis

- ◆ Land use scenarios may not capture all factors of interest
- ◆ Other decision criteria not yet represented
- ◆ Small number of response packages
- ◆ Planning level model does not capture some detailed operations, contracts, or exports



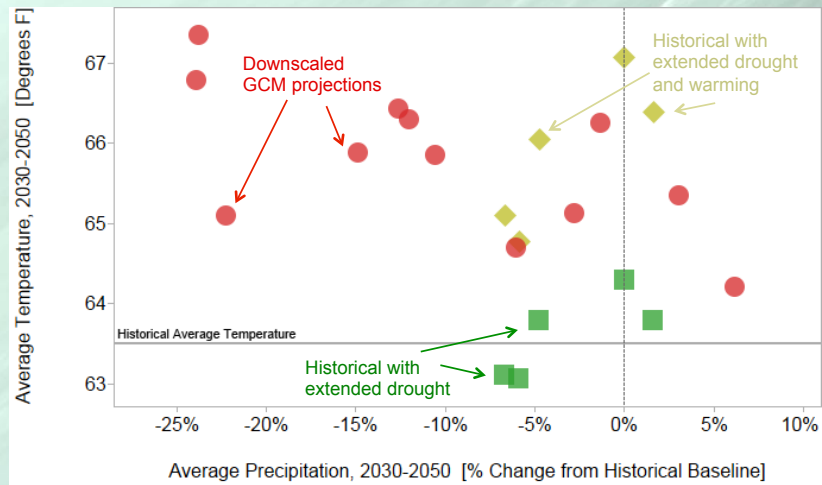
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Nine land use scenarios reflect uncertain population growth and land use patterns



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Twenty-two climate scenarios reflect uncertainty about hydrologic conditions



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Performance of water management system evaluated using four key metrics



💧 Urban reliability



💧 Agricultural reliability



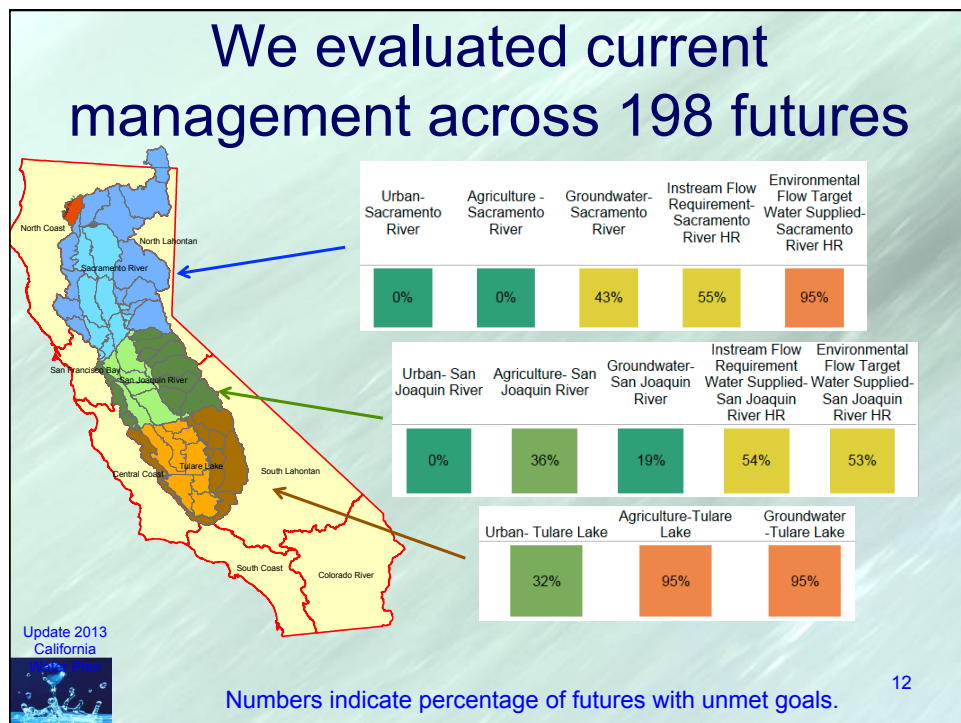
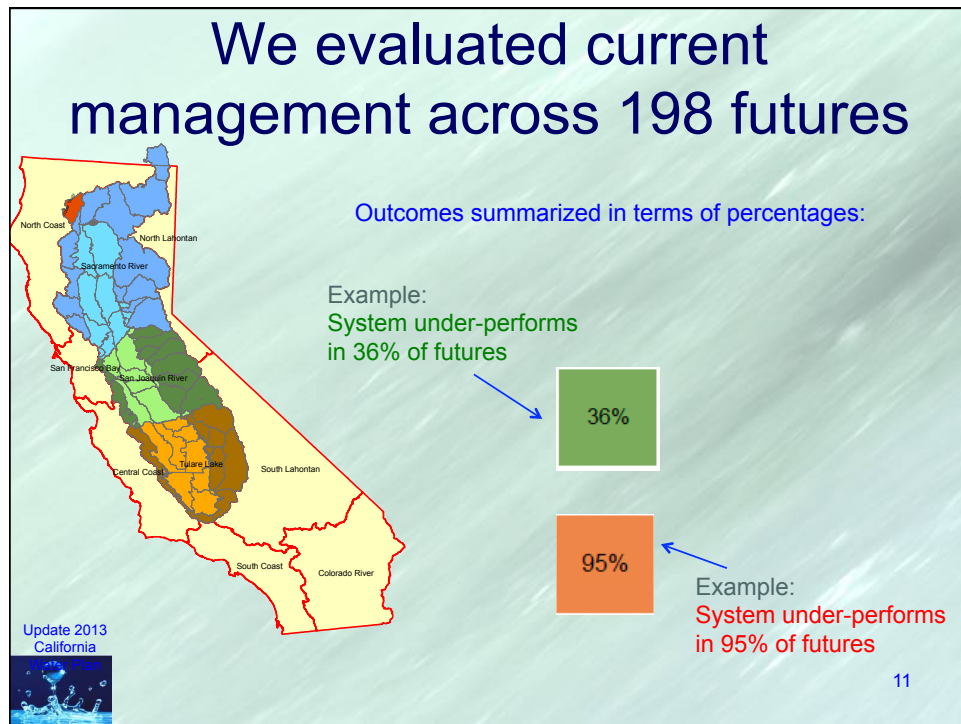
💧 Groundwater levels



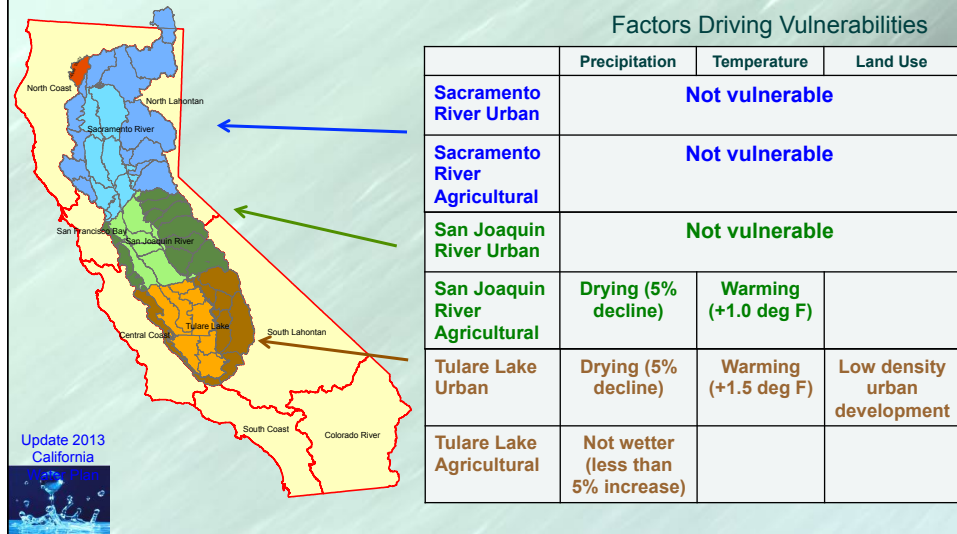
💧 Environmental flows

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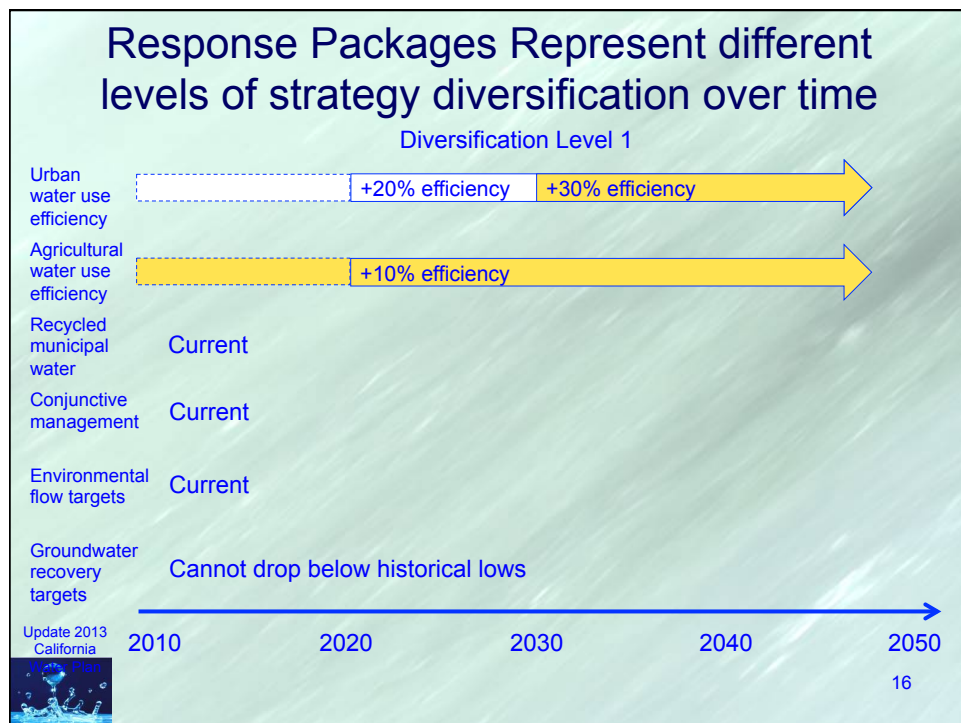
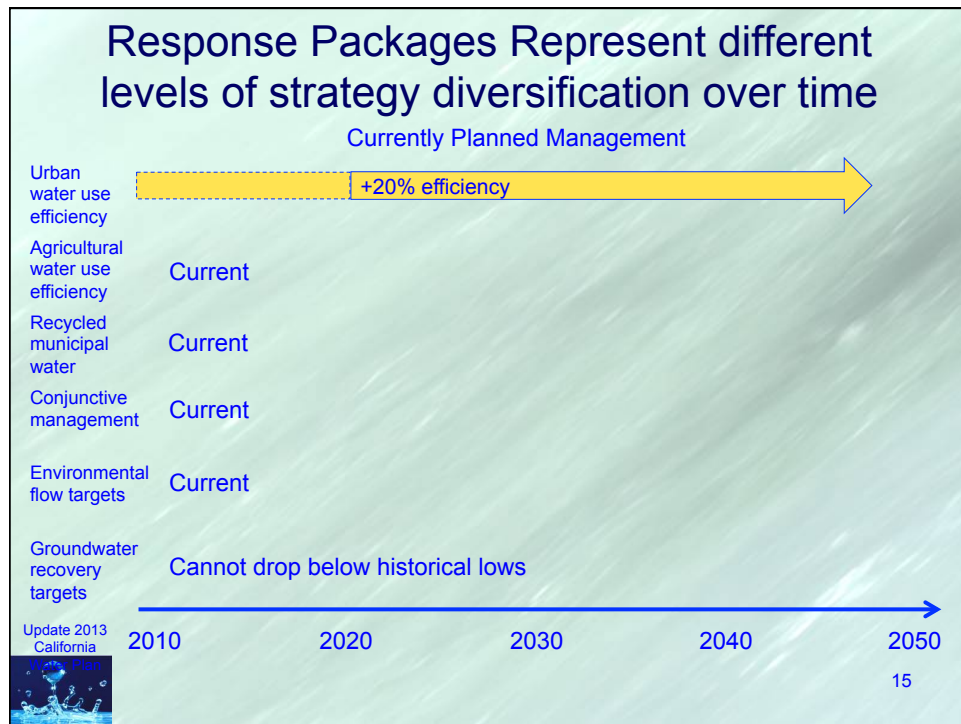


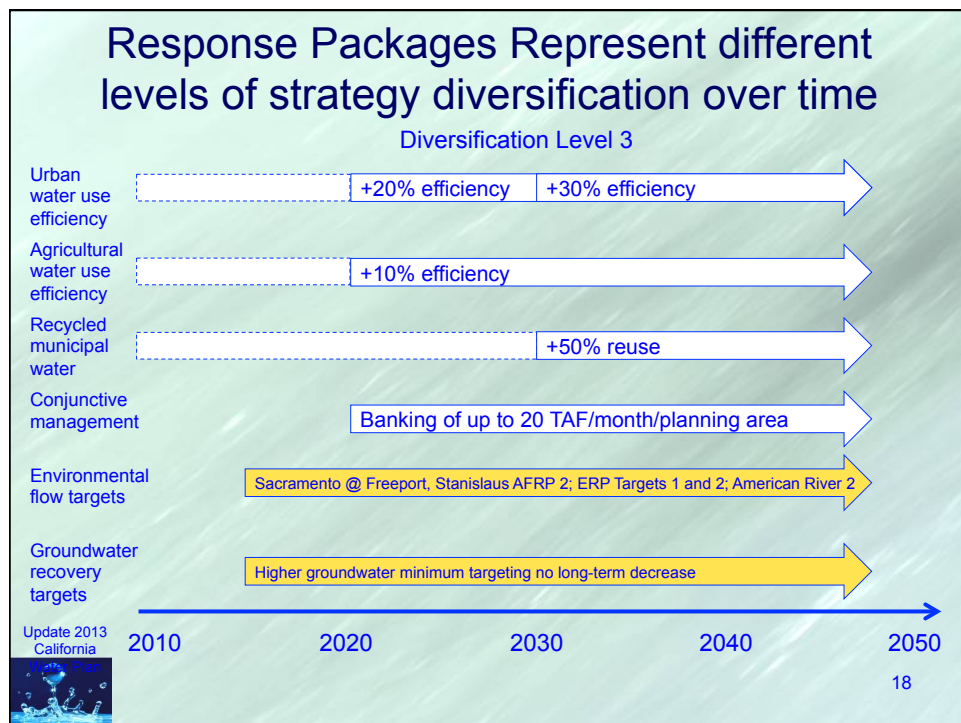
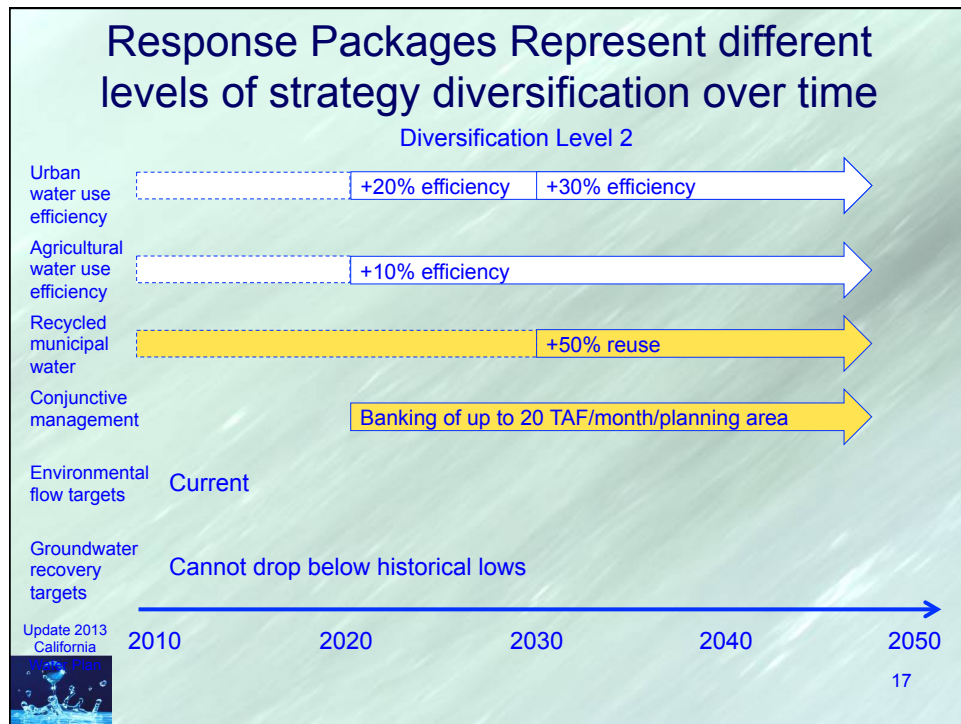
Future climate conditions drive vulnerabilities

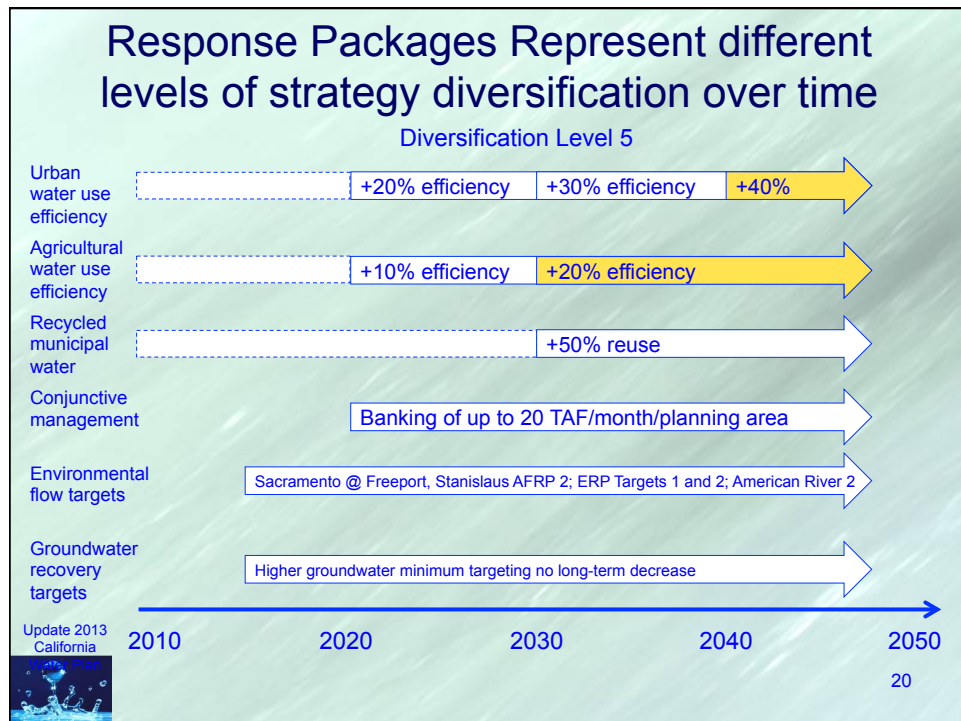
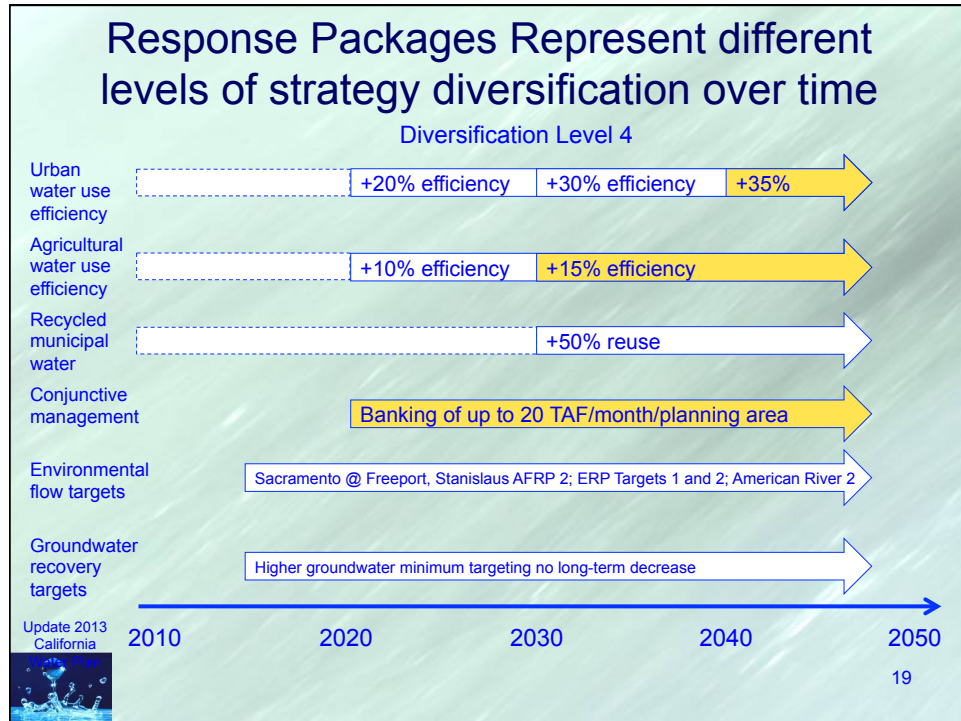


What management strategies can reduce these vulnerabilities?

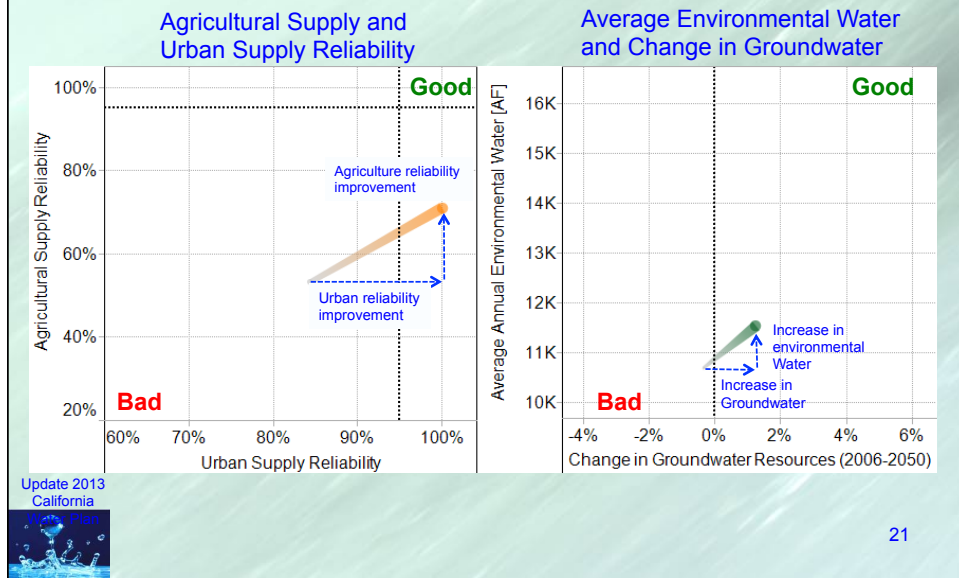
- ◆ Urban water use efficiency
- ◆ Agricultural water use efficiency
- ◆ Recycled municipal water
- ◆ Conjunctive management
- ◆ New environmental flow targets
- ◆ Groundwater recovery targets



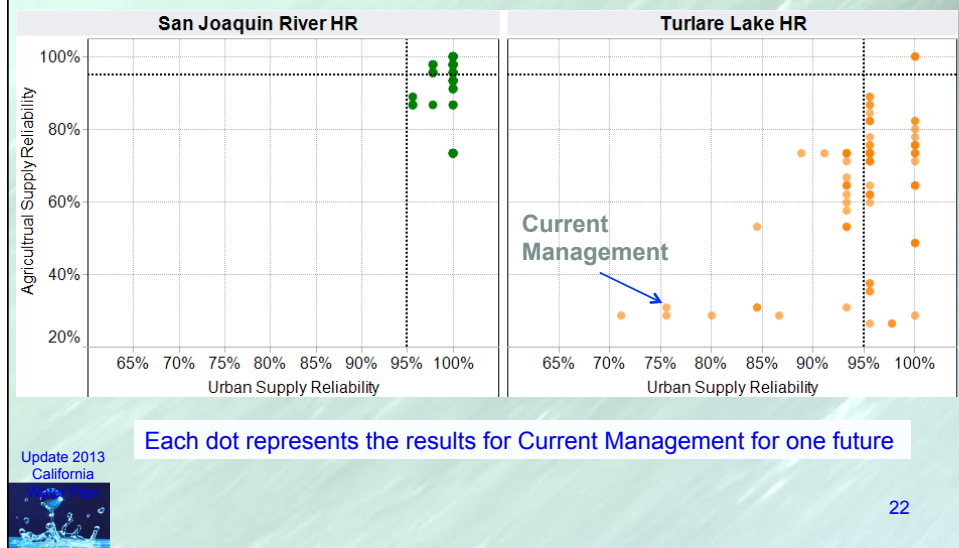


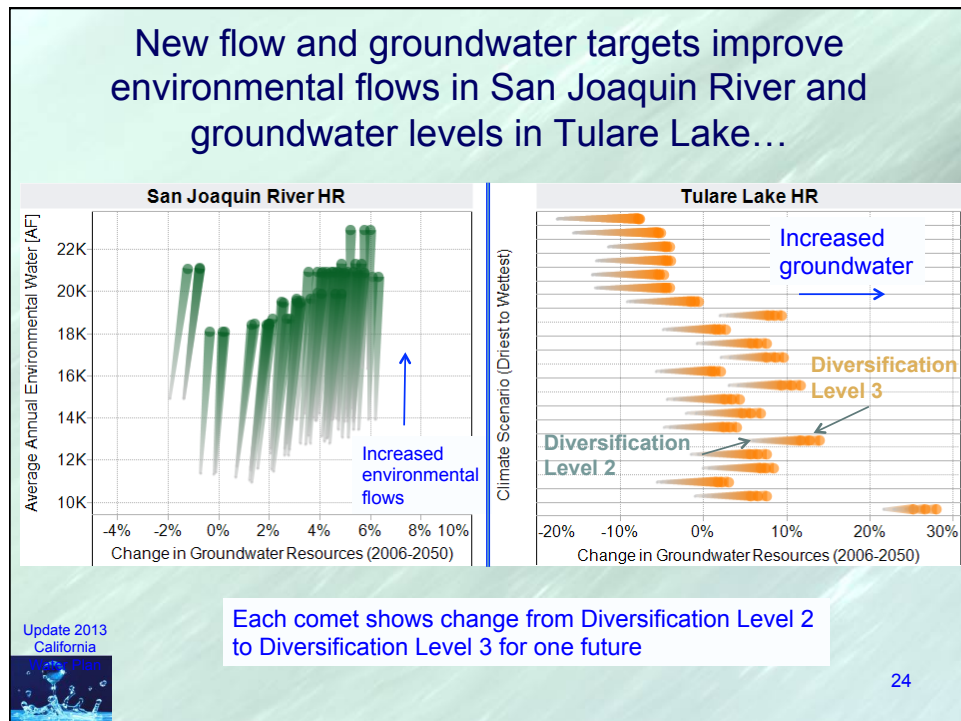
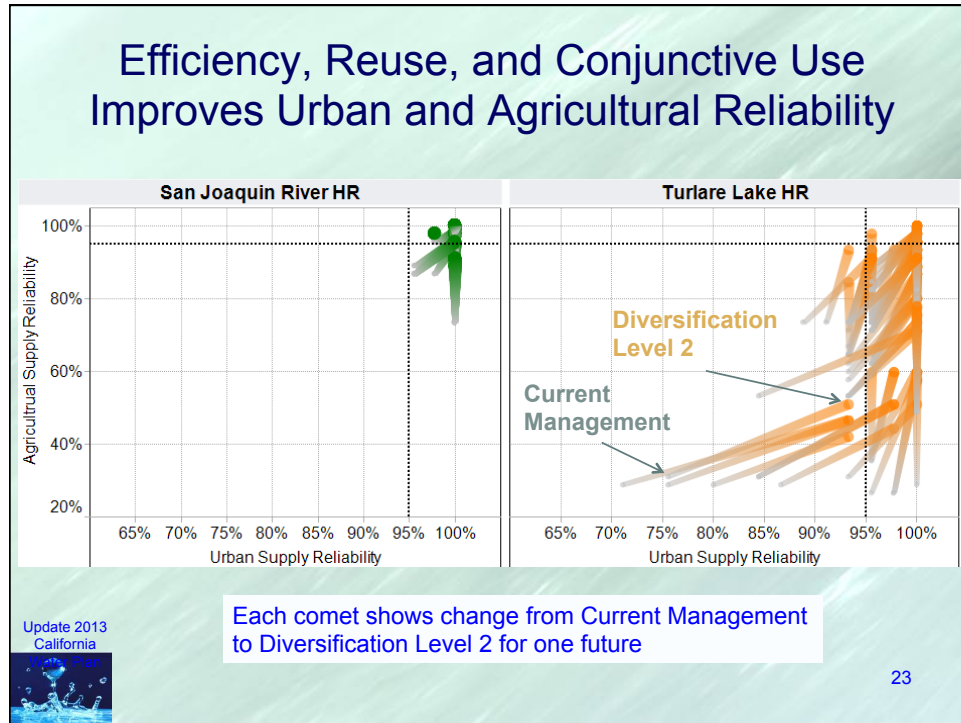


Response packages affect outcomes measured by performance metrics

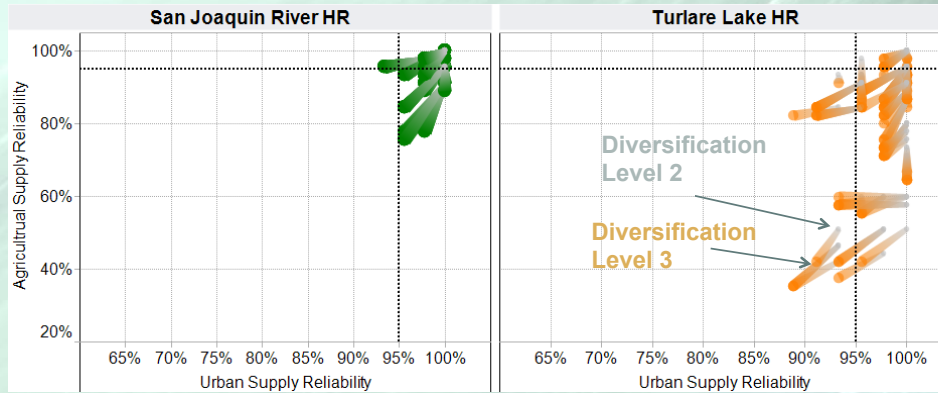


Wide range of outcomes across futures





...but they decrease urban and agricultural reliability

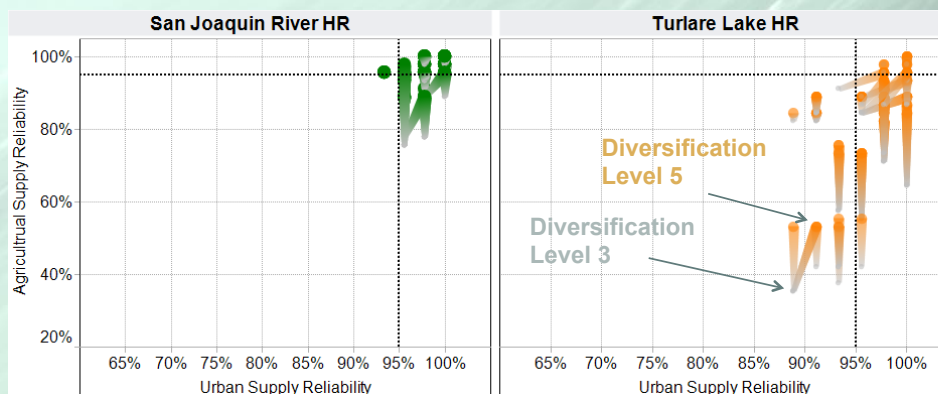


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Each comet shows change from Diversification Level 2 to Diversification Level 3 for one future

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More efficiency compensates for effects of increasing flows and groundwater levels



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Each comet shows change from Diversification Level 3 to Diversification Level 5 for one future

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In summary: response packages improve groundwater and environmental flow targets in Sacramento River

	Urban-Sacramento River	Agriculture - Sacramento River	Groundwater-Sacramento River	Instream Flow Requirement-Sacramento River HR	Environmental Flow Target Water Supplied-Sacramento River HR
Currently Planned	0%	0%	43%	55%	95%
Diversification Level 1	0%	0%	36%	41%	95%
Diversification Level 2	0%	0%	36%	41%	95%
Diversification Level 3	0%	0%	30%	59%	33%
Diversification Level 4	0%	0%	27%	59%	33%
Diversification Level 5	0%	0%	25%	59%	33%

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Colors indicate level of vulnerability (red is higher vulnerability)
Numbers indicate percent of futures that are vulnerable

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In summary: response packages reduce vulnerabilities in San Joaquin and Tulare Lake hydrologic regions

San Joaquin River

	Urban- San Joaquin River	Agriculture- San Joaquin River	Groundwater- San Joaquin River	Instream Flow Requirement Water Supplied- San Joaquin River HR	Environmental Flow Target Water Supplied- San Joaquin River HR
Currently Planned	0%	36%	19%	54%	53%
Diversification Level 1	0%	14%	11%	55%	45%
Diversification Level 2	0%	9%	9%	55%	43%
Diversification Level 3	5%	34%	6%	55%	0%
Diversification Level 4	5%	27%	6%	55%	0%
Diversification Level 5	5%	14%	1%	55%	0%

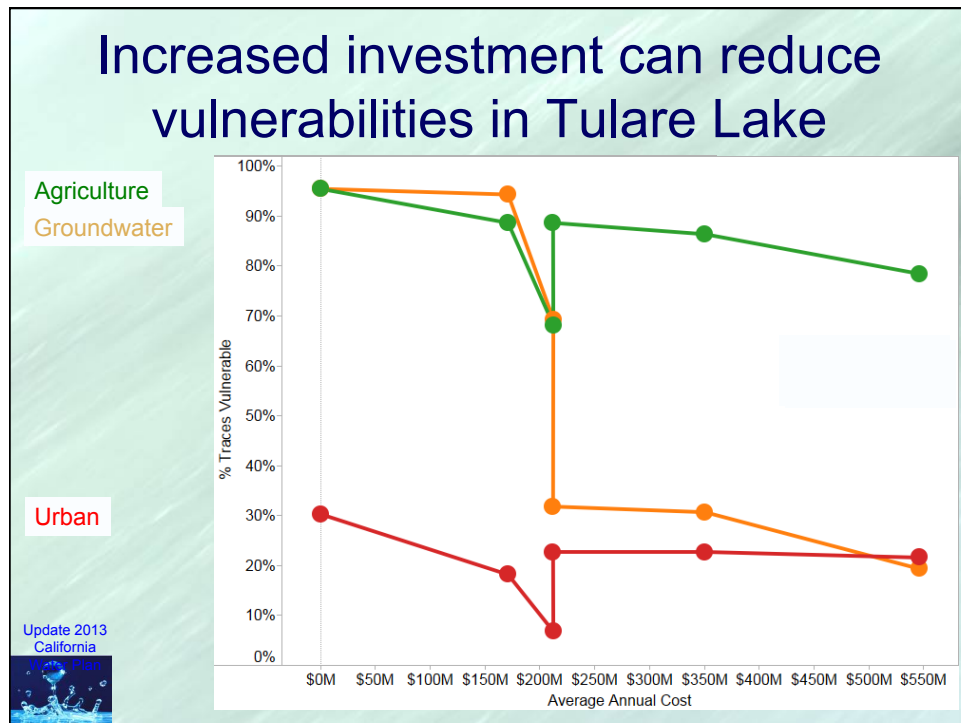
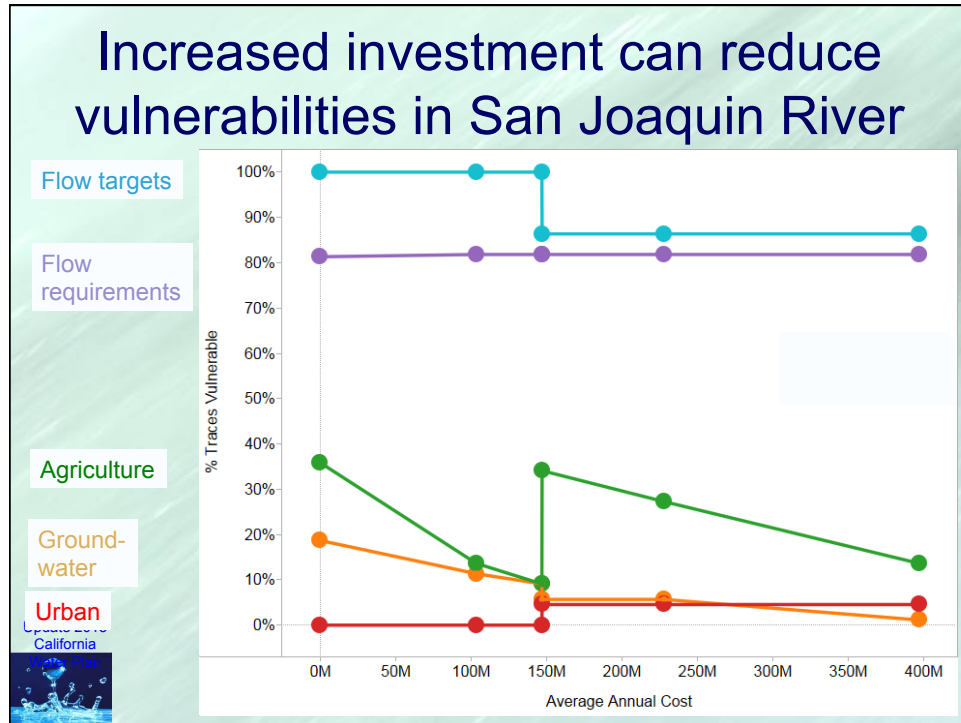
Tulare Lake

	Urban- Tulare Lake	Agriculture-Tulare Lake	Groundwater -Tulare Lake
Currently Planned	32%	95%	95%
Diversification Level 1	18%	89%	94%
Diversification Level 2	7%	68%	69%
Diversification Level 3	23%	89%	32%
Diversification Level 4	23%	86%	31%
Diversification Level 5	22%	78%	19%

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Colors indicate level of vulnerability (red is higher vulnerability)
Numbers indicate percent of futures that are vulnerable

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How to use analysis to inform decisions?

- ◆ Purposefully *high-level* and not designed to inform specific investment decisions
- ◆ Illustrates the *significant future vulnerabilities* facing the Central Valley
- ◆ Shows improvements from *increased diversification* and highlights *key tradeoffs* among diversification levels
- ◆ Framework could support decisions with refined data and models



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Where do we go next?

- ◆ Expand beyond the Central Valley
- ◆ Consider additional uncertainties
- ◆ Evaluate new strategies to address remaining vulnerabilities
- ◆ Evaluate other performance metrics



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